Terrain Adaptive Reconfiguration of Mobility

Completed Technology Project (2017 - 2018)

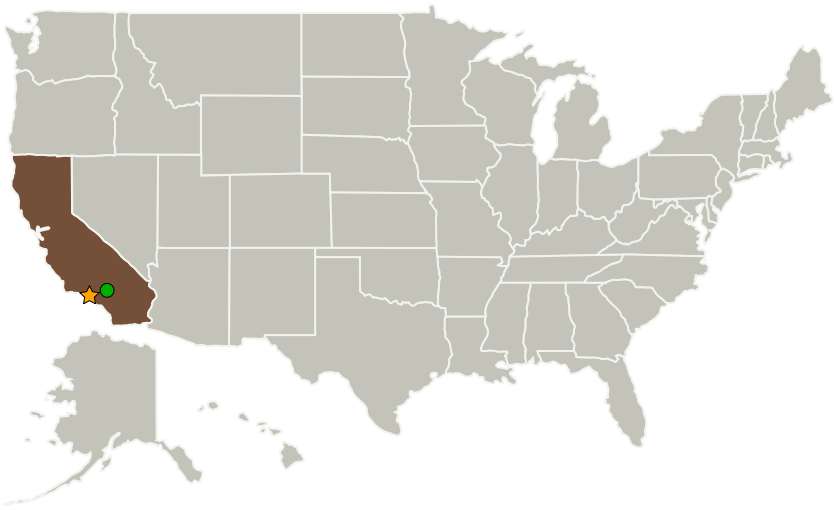
Project Introduction

Develop an algorithm (and software) to automatically adapt a reconfigurable robot to different types of terrains for improved mobility, that compared to SOA: improves traversal efficiency (e.g., vs. always in low gear), and enables traversal over a wider variety of terrains via reconfiguration (vs. avoidance of risker terrain).

Anticipated Benefits

Potential applications include infusion into Mars2020-like missions and missions to Europa, Titan, etc. as a guidance algorithm for assets deployed from the back shell of the spacecraft. Other options include terrestrial missions such as in the oceans and Antarctica.

Primary U.S. Work Locations and Key Partners



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Organizations Performing Work	Role	Type	Location
★Jet Propulsion Laboratory(JPL)	Lead Organization	NASA Center	Pasadena, California
●Armstrong Flight Research Center(AFRC)	Supporting Organization	NASA Center	Edwards, California
California Institute of Technology(CalTech)	Supporting Organization	Academia	Pasadena, California

Primary U.S. Work Locations
California

Project Transitions

October 2017: Project Start

September 2018: Closed out

Closeout Summary: There are a number of concepts under development at NASA Centers and universities on small spacecraft assets that might be deployed as a swarm during descent to a planetary body, often with a focus on Mars. Deployment of a large number (100s-1000s) of assets could enable simultaneous in-situ, spatiotemporal measurements of the Martian atmosphere, something that current single spacecraft missions cannot do. Examples of such concepts include the Prandtl-m glider, the Tensegrity lander, Printable spacecraft, and PUFFER rovers. These assets tend to have low controllability during descent and landing and limited communication capability. Two open issues with these concepts are first, whether or not the assets, upon release, will distribute sufficiently to provide the desired measurement coverage and, second, whether the landed distribution will result in a connected communication network as required to return the data from the distributed nodes. This task first evaluated what would be the desired distribution of assets to ensure both sampling coverage and data return across the swarm and then developed deployment algorithms to achieve the distribution.

Project Website:

https://www.nasa.gov/directorates/spacetech/innovation_fund/index.html#.VC

Organizational Responsibility

Responsible Mission Directorate:
Space Technology Mission Directorate (STMD)

Lead Center / Facility:
Jet Propulsion Laboratory (JPL)

Responsible Program:
Center Innovation Fund: JPL CIF

Project Management

Program Director:
Michael R Lapointe

Program Manager:
Fred Y Hadaegh

Principal Investigator:
Saptarshi Bandyopadhyay

Co-Investigators:
Gary B Doran
Jean-pierre De La Croix
Jaakko Karras

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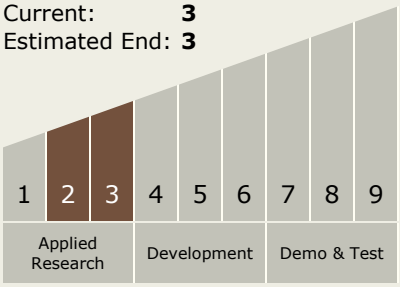
Technology Maturity (TRL)

Start: **2**
Current: **3**
Estimated End: **3**



Technology Areas

Primary:

- TX04 Robotic Systems
  - TX04.2 Mobility
    - TX04.2.4 Surface Mobility

Target Destinations

Mars, Earth, Others Inside the Solar System